

were in full swing in the neighbourhood of Cambridge, and Seeley was to the fore in bringing to light what was to a great extent a new Mesozoic vertebrate fauna, albeit one of which the remains were for the most part in a sadly fragmentary condition.

This was, in fact, the first of Seeley's two great opportunities in this field of research, and he undoubtedly made the most of it, for it is to him that we owe the first discovery of birds in Cretaceous strata—birds which, as Prof. Marsh subsequently showed, retain evidence of reptilian affinity in the possession of a full series of teeth. Much information was likewise acquired at the same time in regard to the structure of pterodactyles, of which numerous remains were obtained in the coprolite workings. The results of these studies were published in a somewhat bald form in a preliminary "index" to the remains of Mesozoic birds and reptiles in the Cambridge Museum.

Although entered as a student at Sidney Sussex College, Seeley never took a degree, and soon after Sedgwick's death he left Cambridge for London, where in 1876 he was appointed to the chair of geography at King's College. In the same year he was chosen professor of geography and geology at Queen's College, London, while five years later he was appointed dean of the college. In 1890 he commenced lecturing on mineralogy and geology at the Royal Indian Engineering College at Coopers Hill, and a year later was appointed to fill the post previously held by Prof. Martin Duncan. Finally, in 1896, he became professor of geology and mineralogy at King's College. As if all this was not work enough for any man, he likewise conducted for many years the excursions of the London geological field class.

In 1862 Prof. Seeley was elected a Fellow of the Geological Society, and in 1879 he was admitted to the fellowship of the Royal Society, while in 1905 a fellowship at King's College was awarded him. He served on more than one occasion on the council of the Geological Society, from which body he also received a medal. The honorary memberships of foreign scientific bodies accorded in honour of his labours are too numerous to mention on this occasion.

The second great opportunity in his career came in 1889, when, under the auspices of the Royal Society, Seeley started for South Africa in order to collect and study the remains of the marvellous anomodont reptiles which render that country of such intense interest to the palæontologist. On his return, he spent a large amount of time and labour on working out his collections, many of the results of these studies being published by the Royal Society in its Transactions. As each section of the work was completed, such specimens as were his own property were presented to the natural history branch of the British Museum, where they form some of the most prized treasures of the fossil reptile gallery.

In this investigation Prof. Seeley definitely recognised the intimate relationships existing between the anomodont reptiles and the lower mammals, a matter on which previous writers had displayed some degree of hesitation and wavering. If he had done nothing else, his claims to a high place in the records of palæontology would have been fully established by the recognition of this one great fact. For the trend of all subsequent work has been to emphasise the intimacy of this relation between mammals and the anomodonts.

In several respects Prof. Seeley was unlike other men, so that his work can scarcely be judged by the ordinary standards, and the time for a final judgment has not yet arrived. That palæontological (to say nothing of geological) science has lost a student with an almost superhuman store of knowledge is, however, admitted by all.

R. L.

NOTES.

ON December 31, 1908, Mr. H. B. Woodward, F.R.S., retired from the Geological Survey of Great Britain, after more than forty years' service. His post as assistant to the director has been taken by Dr. A. Strahan, F.R.S., and the vacancy in the district geologists thus created has been filled by the promotion of Mr. George Barrow.

A POLL has been taken of the proprietors of the London Institution in connection with the proposal to amalgamate the institution with the Royal Society of Arts. The result shows that the majority of the proprietors are in favour of the scheme for the amalgamation of the two societies. A meeting of the board of management of the London Institution is therefore being held as we go to press to consider the next step to be taken.

PROF. J. ARTHUR THOMSON, of Aberdeen University, has been invited by the lecture committee of the South African Association for the Advancement of Science to give the "South African Lectures" for 1909. The lectures are to be delivered in August and September in Johannesburg, Pretoria, Bloemfontein, Kimberley, Cape Town, Grahams town, and Durban, and at the request of the committee they will have special reference to the Darwin centenary. The previous lecturers were Prof. Raleigh, Magdalen College, Oxford, and Mr. Herbert Fisher, New College, Oxford.

THE Paris correspondent of the *Times* reports that on January 6 the driver of the Côte d'Azur express was attacked by an eagle while the train was proceeding from Chalon sur Saône to Fontaines station. The bird, which measured 2 metres across the wings, flew into the cab of the engine, and was only overcome after a severe struggle.

WE regret to notice in *Science* the announcement of the death on December 19, 1908, at the age of fifty-eight years, of Prof. Thomas Gray, professor of dynamics and engineering at the Rose Polytechnic Institute, and distinguished for his work in these subjects.

WE regret to see the announcement of the death, on December 25, 1908, of Major Percy B. Molesworth, R.E., in the forty-second year of his age. He died at Trincomali, Ceylon, where he had been stationed for some years. Major Molesworth was one of the most careful and assiduous of planetary observers, especially of Jupiter and Mars. He published in the Monthly Notices of the Royal Astronomical Society a long series of observations of Jupiter made in 1903-4, and recorded what appears to be a unique instance of perceptible change on the planet's surface in the course of a few minutes. He made a series of observations, amounting to many thousands, of transits of spots on the planet, the results of which were published in the Memoirs of the British Astronomical Association, of which he was one of the most devoted members of the observing sections. He made a fine series of observations and drawings of Mars, extracts from which were published in the Monthly Notices, the full report being placed for reference in the library of the Royal Astronomical Society, of which society he had been a fellow since 1898. He was a member of the British Astronomical Association from its foundation.

A MEDICAL congress, due to the initiative of Sir George Clarke, the Governor, is to be held in Bombay, and will begin on February 22. On the opening day Sir George Clarke will deliver the presidential address, and the sectional meetings will last during the next four days. There will be an exhibition of medical, surgical, and sanitary

appliances. Among others concerned in research work specially affecting India who have expressed their intention of being present at the congress meetings are Profs. Ronald Ross, Kitasato, and Musgrave. Papers are expected to be communicated by Sir Patrick Manson, Sir Lauder Brunton, Prof. Osler, and others. The attendance at the congress is expected to be very large. The secretary of the congress is Colonel Jennings, c/o Messrs. King, King and Co., Bombay.

WE regret to see the announcement of the death of Dr. D. A. Robertson, the distinguished surgeon-oculist, at seventy-two years of age. Dr. Robertson was for several years lecturer on ophthalmology in the University of Edinburgh, and he was president of the International Ophthalmological Congress in 1894. He was an ex-president of the Ophthalmological Society of the United Kingdom, and was president of the Royal College of Surgeons, Edinburgh, in 1886, president of the ophthalmological section of the British Medical Association in 1898, and president of the Edinburgh branch of this association.

MANY geologists and other friends and fellow-workers of the late Mr. Joseph Lomas will welcome the opportunity of subscribing to a memorial fund which is being raised for the benefit of his wife and children. As was mentioned in NATURE of December 24, 1908 (p. 226), Mr. Lomas was killed in a railway accident in Algeria while on his way to study the rocks in the desert region of North Africa, this investigation being undertaken for a committee of the British Association. The devotion to scientific work which characterised Mr. Lomas meant the sacrifice of time and means that might otherwise have been used more selfishly. It is not surprising, therefore, to know that he was unable to make adequate provision for his wife and children. There should be a generous response to the appeal which has just been issued by a committee which includes the names of many distinguished men of science who knew Mr. Lomas, and of which Prof. W. A. Herdman, F.R.S., is one of the hon. treasurers. Subscriptions should be sent to the hon. treasurers, "Lomas Memorial Fund," Education Committee, 14 Sir Thomas Street, Liverpool.

ON Tuesday next, January 19, Prof. Karl Pearson will begin a course of two lectures at the Royal Institution on "Albinism in Man"; on Thursday, January 21, Prof. J. O. Arnold will commence a course of two lectures on "Mysteries of Metals," and on Saturday, January 23, Sir Hubert von Herkomer delivers the first of two lectures on (1) "The Critical Faculty," (2) "Sight and Seeing." The Friday evening discourse on January 22 will be delivered by Dr. Alfred Russel Wallace, on "The World of Life: as Visualised and Interpreted by Darwinism," and on January 29 by Sir Frederick L. Nathan, on "Improvements in Production and Application of Gun-cotton and Nitro-glycerin."

SINCE the great earthquake in Sicily and Calabria on December 28, 1908, there have been a number of aftershocks, and a little additional information about the disturbance. Prof. Oddone informed a Press representative on January 6 that the observatory building at Messina has been damaged, but a subterranean chamber used for seismic investigations has escaped harm. The Vicentini seismograph registered the great earthquake up to the moment of maximum intensity, and the record is considered to be of considerable interest in the study of the earthquake. From the record it appears that the earthquake began with a very slight shock, which was re-

peated. It increased in violence for ten seconds, and then grew less severe for another ten seconds. After these movements ten minutes passed without disturbance. A second shock of much greater intensity, and accompanied by loud subterranean rumbling, followed, and was the cause of the catastrophe. In the afternoon of January 7 several distinct shocks were felt at Reggio. Shocks continued during the whole of the night, some of them being strong ones preceded by a humming noise. On January 8 the entire west coast of Mexico was shaken by an earthquake. Three strong earthquake shocks were felt at Messina between 12.15 p.m. and 12.30 p.m. on January 9. Reuter telegrams to New York from Seattle, Bellingham, Tacoma, Vancouver, and Victoria state that an earthquake shock was felt in those places at 3.44 p.m. on January 11, and again during the evening.

WE learn from the Journal of the Royal Society of Arts that Sir Thomas Wardle, who died at his residence, Leek, Staffordshire, on January 3, in his seventy-eighth year, was the first business man to discover a satisfactory process of dyeing the wild *tussur* silk of India, and, at the instance of Sir George Birdwood, he was sent out by the Secretary of State for India, in 1885, to report on sericulture in Bengal. This was the first of several visits to the East, and in his work, "Kashmir and its New Silk Industry" (1904), Sir Thomas Wardle gave an account of the manner in which, mainly through his instrumentality, the moribund industry was, after innumerable difficulties, placed upon a footing of greater prosperity than it had ever enjoyed before. He wrote numerous monographs upon the technical aspects of sericulture and silk-weaving, and he was the honorary expert on silk of the Imperial Institute, president of the Silk Association of Great Britain and Ireland, and honorary secretary of the Ladies' National Silk Association. He was a Fellow of the Chemical, Geological, and Royal Statistical Societies, and a member of the council of the Palæontographical Society. He became a member of the Society of Arts in 1878. In the following year he read his first paper, on the wild silks of India, principally *tussur*, for which he received the society's silver medal. Since then he contributed three papers, on researches on silk fibre, the history and description of the growing uses of *tussur* silk, and improvements in the design, colouring, and manufacture of British silks.

THE arrangements made by the British Meteorological Office for the transmission of meteorological reports by wireless telegraphy from ships at sea were referred to in last week's NATURE (p. 287). The annual summary of the work of the U.S. Weather Bureau, recently published in the *Monthly Weather Review*, describes what is done in this direction in connection with that Bureau. The essential feature of this weather service is the collection by wireless telegraphy of meteorological observations from vessels at sea, and the dispatch by the same means to vessels at sea of weather forecasts and storm warnings based upon the observations thus collected. Vessels of the following lines, all equipped with Marconi apparatus, have been authorised to transmit to the Bureau the record of the daily Greenwich mean noon meteorological observations, and have been supplied with the telegraphic code, forms, &c., required for that purpose:—American Line, North German Lloyd, Hamburg American Line, Cunard Line, White Star Line, Compagnie Generale Transatlantique, Allan Line, and Canadian Pacific Steamship Line. The privilege has also been extended to vessels of the Panama Railroad and Steamship Company and the Mallory Line, equipped with the De Forrest system; also

to the Pacific Steamship Company, equipped with the Massie system. There appears to be only one vessel on the Pacific carrying wireless apparatus. Other vessels are said to be in course of equipment, and the wireless weather service on that coast, in view of its supreme importance in the matter of local forecasting, is to be prosecuted with vigour. The wireless telegraphic weather service and code have also been adopted by the U.S. Navy Department, and all vessels of the U.S. Navy are instructed to transmit the daily weather despatch while at sea. The wireless telegraphic stations controlled by the Navy Department are also required to receive weather messages from merchant vessels and to transmit them to the Bureau, likewise to dispatch the weather forecasts and storm warnings issued by the Bureau to vessels at sea demanding them, free of cost. The total number of wireless weather reports received during 1907 from vessels at sea was 738. Of this number, 679 were from Transatlantic liners distributed along the route between Sandy Hook and longitude 44° west.

RECENTLY, Indiana University came into possession of a farm of about 180 acres, celebrated for its natural beauty and for the possession of a subterranean stream, which comes to the surface in two places before finally emerging from the base of a cliff in one of the most picturesque cave-entrances in America. Of the fauna of this tract a comprehensive account is given by Mr. W. L. Hahn in No. 1655 of the Proceedings of the U.S. National Museum, the most interesting element in this being formed by the denizens of the caves and underground stream.

IN its report for the year ending on September 30 last, the committee of the Bristol Museum and Art Gallery refer to the visit to that institution paid by their Majesties the King and Queen on the occasion of their coming to the city to open the Royal Edward Dock at Avonmouth. Lady Smyth, widow of Sir Greville Smyth, of Ashton Court, contributed during the year a munificent donation for the purpose of fitting up a room for the display of the collection of invertebrates made by her late husband and presented by herself, this chamber to be called the "Greville Smyth Room."

THE heronries of Lincolnshire and Somersetshire form the subject of an article by the Rev. F. L. Blathwayt in the *Zoologist* for December, 1908. Formerly the south-eastern portion of Lincolnshire was renowned for the number of its heronries, which included those of Leake (near Boston), Spalding, Donington, and Cressy Hall, all of which are now extinct. The Leake heronry occupied a very large tree, which was literally covered with nests, until it was felled about the year 1830; while the Cressy heronry, which was described by Pennant in 1769, contained some eighty nests. At the present day only five heronries in the county are known to the writer, the largest of which is reported to contain twenty pairs of birds.

THE *Journal of Comparative Neurology and Psychology* for November, 1908 (vol. xviii., No. 5), contains an English translation of a masterly address delivered before the third congress for experimental psychology by Dr. Ludwig Edinger, on the relations of comparative anatomy to comparative psychology. Great results, it is urged, would ensue if these two sciences were practically studied together, as is demonstrated by what has been already accomplished whenever such a union has taken place. The author lays great stress, from a psychological point of view, on dividing the brain into a "palæencephalon"

and a "nēencephalon," the latter comprising the hemispheres, and the former all the remainder of the structure. The palæencephalon is alone present in bony fishes, and since in all vertebrates a totally different (nēencephalic) type of activities makes its appearance, the importance of a close psychological study of fishes is self-evident. Not only all the activities commonly termed reflex, but all instincts are localised in the palæencephalon, as is demonstrated by the fact that flight when surprised, migrations, nest-building, courtship, and many other activities are noticeable in the bony fishes. With the appearance of the nēencephalon the behaviour of the animal undergoes a complete change. Something has been done in assigning their proper functions to the various divisions of the brain, but a vast amount of work still remains to be accomplished in this field; such investigations must, however, be carried on both anatomically and psychologically at the same time, when observations on the living animal are impossible, if any good result is to accrue.

IN the December (1908) number of the *Bio-Chemical Journal* (iii., No. 10) Prof. Moore discusses the question of variation of the amount of free hydrochloric acid of the gastric contents in cancer, particularly in relation to some recent criticisms of his results, and maintains that, generally, the free hydrochloric acid of the gastric contents is diminished in cancer cases, no matter in what part of the body the disease is situated.

IN the Bulletin of the Johns Hopkins Hospital for December, 1908 (xix., No. 213), Mr. Victor Bloede discusses a comprehensive scheme for dealing with tuberculosis. It contemplates the combined and simultaneous operation of four agencies, each indispensable in itself:—(1) the dispensary where the cases are investigated, diagnosed, and classified; (2) the hospital for advanced cases; (3) the sanatorium for incipient cases; (4) the farm colony for the after-treatment of arrested cases, where the patients receive further benefit to their health and are gradually restored to the rank of self-respecting workers, as well as contributing something to the upkeep of the institutions.

WE have been favoured with a copy of the exchange list of seeds of hardy herbaceous plants and of trees and shrubs issued by the director of Kew Gardens as Appendix I. to the *Kew Bulletin* of the current year.

IT is noted in the report for 1907-8 on the botanic station, Montserrat, that the cultivation of cotton on the island is making very favourable progress, as the outturn was double that of the previous year. Of various experiments carried out by the curator, Mr. Robson, the one most generally interesting was intended to ascertain whether the clean and fuzzy cotton seeds produced plants true to type; such was found generally to be the case, and fortunately so to a larger extent in the case of the fuzzy seed that is associated with the better quality of lint.

THERE is a conflict of opinion regarding the value of the special bacterial cultures that have been introduced with the view of increasing the nodule formation, and therefore the productiveness, of leguminous plants. Experiments with nitro-bactrine, carried out at the Royal Horticultural Society's Gardens, and described in the *Journal* (vol. xxxiv., part ii.) by Mr. F. J. Chittenden, are decidedly adverse. Trials were made with inoculated soil and inoculated seed both on untreated and manured soil; but despite the fact that the soil is naturally lean, and therefore, it would be supposed, specially suitable for inocu-

lation, the nitro-bactrine effected no improvement in the crops. It should be noted that all the experiments were confined to the cultivation of peas.

Two papers occupy a large portion of the nineteenth report of the Missouri Botanical Garden. Mr. C. S. Sargent contributes a memoir on the species of the critical American genus *Cratægus* found in Missouri. He identifies no fewer than 110 species, of which a large number are endemic, and more than half are new to science; this, by the way, is said to be a preliminary study. The second paper, dealing with the types of vegetation found in a normal cross-section taken across the Mississippi River near St. Louis, is communicated by Mr. H. Hus. The physiographical divisions on either side of the river are distinguished as bottom-lands, bluffs, and highlands. Forests and limited prairies are characteristic of the highlands. In the forests the black oak, *Quercus coccinea*, associated with other oaks and hickories, is dominant. Curious features are the sink-holes, originally forming entrances to caves, that have in many cases been closed, when the holes have been transformed into ponds. *Hydrastis canadensis*, *Polygonatum giganteum*, and *Arisaema triphyllum* are characteristic plants found therein.

BULLETIN No. 118 of the Perdue University Agricultural Experiment Station, drawn up by Messrs. Troop and Woodbury, contains popular instructions for fruit-growers on various common orchard pests. Methods of recognition are given and remedial measures are described; there is also a good deal of sound advice on general management. Bulletin No. 116 of the West Virginia University Agricultural Experiment Station deals with the same subjects as they affect the West Virginian fruit-grower. In view of the increasing attention that is being devoted in this country to the improving of orchards, and in particular to spraying, English horticultural instructors will find much to interest them in these publications.

THE Imperial Agricultural Department of the West Indies has issued a bulletin, by Mr. Stockdale, dealing with the fungus diseases of cacao and the sanitation of cacao orchards. The diseases described are canker, "die-back" (caused by *Diplodia cacaoicola*), lasiodiplodia, "pink disease" (caused by *Corticium lilaco-fuscum*), thread blights (*Marasmius equicrinus* and other fungi), witchbroom disease (*Exoascus theobromae*), and others. Most of these diseases have been under experiment for some years, having been investigated by Mr. Howard in 1901, and it has been satisfactorily demonstrated that they are amenable to treatment. The methods found to be most effective are collected together, and the bulletin thus affords an interesting survey of the work done up to the present on this particular subject.

THE current issue of the *Transvaal Agricultural Journal* is up to its usual high standard, and includes a number of articles of local importance, besides others of more general interest. Dr. Theiler gives an account of the results he has obtained by inoculating sheep against blue tongue. He finds that vaccination is more effective, and attended with less risk, than the older method of simultaneous serum and virus injection. The mortality returns from vaccinated portions of the flocks compare instructively with those from unvaccinated portions; 11 per cent. of the unvaccinated sheep died, but only 0.4 per cent. of those vaccinated. It is a matter of fundamental importance to the Transvaal farmer, and of great credit to the Transvaal Agricultural Department, that this disease

should have been brought under control. The number of diseases, both of animals and of plants, in the Transvaal is great, but is steadily being rendered less formidable by the persistent efforts of the Agricultural Department.

THE work of the agricultural experiment station in connection with the University of Maine is at the present time organised under four departments—chemistry, entomology, vegetable pathology, and biology. The work is entirely investigational, except in the department of chemistry. With a single exception, none of the staff does any teaching or has any duties other than those directly connected with the work of his department. We have received a report on the work of the biological department. The general problem on which the department is working is that of genetics, which is studied by observational, experimental, and statistical methods of biological investigation. The work is carried on in two laboratories. In addition, the department has available what is probably one of the largest and best equipped experimental poultry plants anywhere in existence. The work in plant breeding proper and on any problems which involve the use of plants as material is at the present time being carried on on rented land. The work of the department falls at present into three general lines of investigation as follows:—genetics, physiology of reproduction in the domestic fowl, and the laws of growth. Each of these topics may be considered somewhat in detail. The work in *genetics* includes hybridisation studies, the influence of selection upon the inherited characters of organisms, and quantitative studies of the method and degree of inheritance of various characters in plants and in poultry. Under the physiology of reproduction are being studied the physiology of egg production within the individual, the physiology of egg production within the race, the influence of environmental factors (in the broadest sense), the relation of internal factors to, and their influence upon, processes, and the pathological and teratological cases relating to egg production. During the present year a detailed study of the growth of the maize plant has been made, with particular reference to the following factors:—gametic constitution of the growing individual, intra-individual variation, and racial variation.

In the *National Geographic Magazine* for December last Mr. A. J. Mayer describes a cruise along that most neglected part of the Atlantic coast lying between the mouth of Chesapeake Bay and north Florida. In the course of the voyage we pass from a temperate region of chestnuts and beeches to the border lands of the tropics in the Florida palmetto groves. In the animal world there is ample evidence of the wanton destruction of life—waterfowl, wild turkey, deer, bears, and alligators—while the forests are disappearing under the axe or are being destroyed by the wasteful turpentine industry. Unless early measures are taken to conserve the game and forests, a region which might become the favoured haunt of the sportsman and naturalist will be converted into a barren waste.

THE January issue of the *Reliquary* contains two useful articles on early ceramics. The first, by Mr. A. G. Wright, curator of the Colchester Museum, describes the collection of late Celtic and Roman pottery in his charge, which, for the number of specimens and the great variety of wares, is probably unequalled in northern Europe. Specially remarkable is the splendid cinerary urn of the Bronze age, the second largest of its class discovered in Britain, the other and greater example being preserved in the Devises Museum. Among the vessels of the Iron

age, the pedestalled vases, derived, as Dr. A. J. Evans has pointed out, from the Situla in vogue south of the Alps about the fourth or fifth centuries B.C., deserve notice. Two groups of fine Celtic sepulchral vessels found at Colchester and Braintree are figured and described. The second paper, by Mr. M. E. Cunningham, discusses a find of fragments of Arretine ware from a late Celtic rubbish-heap at Oare, in Wilts. This ware is particularly rare in England, because just about the time when this country came under Roman domination it was superseded by the red-glazed Gaulish ware from the potteries established at Graufesenque in the middle of the first century A.D.

PROF. T. LEVI CIVITA has published in the *Atti dei Lincei*, xvii. (2), 1, a discussion of the attraction exerted by a material line on points in its immediate neighbourhood. The object is to discuss, by rigorous methods of modern analysis, the asymptotic forms to which the potential and its derivatives tend as the point approaches and ultimately lies on the line itself. The same methods are applicable, as Prof. Levi Civita shows, to the vector potential of a vortex filament. This corresponding hydrodynamical problem was first discussed by Da Rios in 1906. Readers of ordinary text-books will know that the expression for the translational velocity of a circular vortex commonly given contains a logarithm which becomes infinite at a point on the vortex itself. In a further paper in the same journal (xvii. [2], 9) the attraction of a thin tube of finite density is discussed.

ON December 7, 1908, Mr. Herbert Chatley gave a lecture on mechanical flight before the Society of Engineers. The printed account of the lecture contains about as clear and concise a statement of the present position of the problem as could possibly be condensed into fifteen pages. The relative advantages of the *aéroplane*, *hélicoptère* and *ornithoptère* are briefly stated, but the point most emphasised is the need for scientific research both in connection with the study of air resistance and in connection with stability. These researches are bound to come sooner or later, for the work is perfectly well defined and straightforward, and want of opportunity has been the only hindrance which has given the lead to methods of trial and error. Mr. Chatley does not anticipate that aerial navigation will cause any great revolution in war and commerce for some years to come. He, however, wishes to point out the deplorable backwardness of English invention in this direction.

PROF. M. LAUE, in the *Physikalische Zeitschrift*, ix., 22, pp. 778-80, directs attention to an apparent paradox in the application of the concept entropy to radiation phenomena. If a beam of light falling on the surface separating two media is broken up into a reflected and a refracted beam, the two are capable of being re-united, under ideal conditions, into a single beam, and no entropy change can accompany the process. On the contrary, two beams from different sources, but identically similar in all other respects (non-coherent beams), cannot be so united, and their total entropy is apparently greater than that of the original beam. According to the statistical or probability definition of entropy, the difference is easily accounted for. On the thermodynamic aspect, the entropy of the coherent beams as a whole appears different from the sum of the entropies of the parts if the latter are estimated for each part independently without taking account of the presence of the other. The properties do not appear to be out of accord with the laws of thermodynamics so far as these are defined in terms of changes of available energy due to irreversible transformations. The available energy

of a beam of light is increased by the presence of a coherent beam, and if a pair of such beams could be generated from independent sources we should undoubtedly be able to overcome the second law (and make our fortunes?), but such a possibility is contrary to existing experience.

THE method of thermal analysis, *i.e.* the observation of the change of temperature with time of a material in a cooling furnace, has been used so extensively in metallurgical research during the last twenty years, and has assumed so many different forms in the hands of experimenters, that the critical examination of the various methods from both experimental and theoretical points of view which Mr. G. K. Burgess contributes to the November (1908) number of the Bulletin of the Bureau of Standards will be welcomed by all metallurgists. Mr. Burgess comes to the conclusion that from both points of view the most certain and complete data may be obtained by combining the observations of variation of temperature with time with those obtained by taking the differences of temperatures of the material under test and a standard material cooling under the same conditions. He points out, however, that for accurate quantitative work it will be further necessary to take into account the effect of the cooling of the furnace itself on the rate of cooling of the specimen within it.

IN NATURE of November 19, 1908 (vol. lxxix., p. 75), Prof. Perry directed attention to the admirable pioneer work in the practical teaching of science and technology done by the late Prof. Ayrton so long ago as 1879 at the Finsbury Technical College. Sir Oliver Lodge, in a letter to NATURE (vol. lxxix., p. 129), supplemented this information by an account of similar work accomplished, certainly in 1872 and perhaps as far back as 1866, at King's and University Colleges in London by Prof. Carey Foster and others. Prof. Chas. R. Cross, of the Massachusetts Institute of Technology, Boston, U.S.A., now sends us a printed copy of a report on the physical laboratory of the institute written by Prof. E. C. Pickering, then Thayer professor of physics at the institute, which shows that in 1864 President Rogers proposed a laboratory for the institute in which "the student may be exercised in a variety of mechanical and physical processes and experiments"; and in October, 1868, "a room was opened to advanced students where they carried on physical investigations, as is done by many physicists with their special students." It appears evident that even more than forty years ago several men of science were beginning to appreciate the need, which is now recognised universally, for properly organised experimental work by students themselves if the instruction given in physical science is to be thorough and satisfactory.

THE Berlin Photographic Company, 133 New Bond Street, W., has sent us several portraits of distinguished men of science from a collection published by the company under the title "*Corpus Imaginum*." The portraits are photogravures on plate paper, the size of the picture itself being in each case about 6 inches by 9 inches, and the price of each plate is 3s. We have no hesitation in saying that the portraits are extremely fine, and that they should decorate the walls of many studies and schools. The portrait of Lord Kelvin, which is among the selection sent to us, is certainly the truest picture of him we have ever seen. Among other eminent men of science included in the collection published by the company are Bunsen, Cuvier, Darwin, Faraday, Helmholtz, Herschel, Huxley, Liebig, Lister, Mendeléeff, Newton, Owen, Pasteur, Sir

W. Ramsay, Richthofen, and Tyndall. We miss, however, a number of well-known names, as, for instance, the following, who have occupied the president's chair of the Royal Society:—Sir Joseph Banks, Sir Humphry Davy, Sir Joseph Hooker, Sir George Stokes, Sir William Huggins, Lord Rayleigh, and also the present president, Sir Archibald Geikie. Perhaps the company will be able to extend its collection of portraits by the addition of these and a few other British men of science of world-wide renown.

THE Selborne Society has revived the old title of its magazine, which will henceforth be called *The Selborne Magazine (and Nature Notes)*, and will be published by Messrs. George Philip and Son, Ltd., 32 Fleet Street, E.C. All communications with regard to the society should be addressed to the honorary general secretary, Selborne Society, 20 Hanover Square, London, as heretofore.

THE January number of *Knowledge and Scientific News*, which is the first number of the enlarged series, contains a five-page illustrated article on the Cavendish Laboratory and Sir J. J. Thomson from the pen of Dr. A. Wood, who has himself worked in the laboratory for the last half-dozen years. He gives an outline of the history of the laboratory, and points out the prominent position it has taken in the march of science during the last twenty years. Views of the original laboratory and of the extension recently opened by Lord Rayleigh are given, but readers will value most the excellent reproduction of the portrait of Sir J. J. Thomson, in which he has his hand on the commutator of an induction coil and his keen eye on the vacuum tubes in front of him.

OUR ASTRONOMICAL COLUMN.

FURTHER PHOTOGRAPHS OF MOREHOUSE'S COMET.—Prof. Barnard describes, and reproduces, more photographs of comet 1908c in the December (1908) number of the *Astrophysical Journal* (vol. xxviii., No. 5, p. 384). The four reproduced were selected because they illustrate so well the remarkable changes which took place in the comet; they were taken on October 14, 15, 16, and 30, 1908.

These changes have been described before, but Prof. Barnard directs attention to one or two peculiarities of especial interest. A comparison of the plates taken on October 15 and 16 appears to indicate that there was no acceleration of the motion of the ejected matter in the direction of the length of the tail. From the photographs taken on the former date it appears to Prof. Barnard that the ejected masses moved southwards at a greater rate than did the comet, thus producing the observed changes in position angle of the various sections of the tail.

Prof. Barnard believes that the masses forming the tail were actually ejected by the action of the comet itself to a large extent, and states that both in this and in Daniel's comet he observed pulsations of light at irregular intervals, such as might be expected to accompany the violent actions which would eject such masses. He also directs attention to the great difference between the visual and the photographic brightness of this comet; in a moonlit sky the tail could not be observed visually, yet a good photograph, showing an extension of eight or nine degrees, was obtained when the moon was $10\frac{1}{2}$ days old.

According to the measures of the photographs taken on October 15 and 16 respectively, the uniform value of the recession of the detached masses was about 3'5 per hour.

SEARCH-EPHEMERIS FOR HALLEY'S COMET.—A search-ephemeris for Halley's comet, submitted by an unnamed competitor for the *Astronomische Gesellschaft* prize, appears in No. 4295 of the *Astronomische Nachrichten* (p. 369, December 31, 1908). It gives the computed positions of the comet at intervals of ten days for the present year, and for every fourth day, commencing at January 2, in 1910. Observers should remark that this ephemeris

differs, for the present epoch, from that previously given by Messrs. Cowell and Crommelin, whilst the difference between it and that computed by Dr. Smart (*Monthly Notices*, March, 1908, p. 394), for January 2, 1910, amounts to more than 3h. in R.A. and to nearly 4° in declination.

THE DISTRIBUTION OF ERUPTIVE PROMINENCES ON THE SOLAR DISC.—Some interesting statements concerning the nature and distribution of eruptive prominences on the sun's disc, and of their relations to spots, are made by Mr. Phillip Fox in No. 4, vol. xxviii., of the *Astrophysical Journal*.

From observations made with the Rumford spectroheliograph, Mr. Fox deduces that the especially brilliant points in the flocculi adjacent to spots, designated "eruptions" by Hale and Ellerman, are the bases of eruptive prominences. Evidence of this has accrued from the fact that when these eruptions have been observed near the limb, they have been found to coincide with eruptive prominences projecting above the limb.

The position of these eruptive prominences in relation to spots leads to the conclusion that the spot is preceded by, and has its genesis in, an eruption; this appears to be so generally the rule that Mr. Fox thinks it is safe to predict the advent of a spot whenever an isolated eruption is observed.

An examination of all the H α spectroheliograms shows that solar vortices are counter-clockwise in the northern and clockwise in the southern hemisphere.

Mr. Fox suggests that the location of eruptive prominences between the members of well-developed spot groups, and their absence in front of the leading spot, may be due, at least in part, to the interference of the whirls circulating around the various spots.

DOUBLE-STAR ORBITS.—The orbits of η Cassiopeiae and γ Coronae Borealis are re-discussed, in the light of the more recent observations, by Prof. Doberck in No. 4296 of the *Astronomische Nachrichten* (pp. 383-6, January 2), and revised elements are given for each.

According to these elements, the period of the former star is 507.60 years and the eccentricity of the orbit is 0.5220, whilst for γ Coronae the corresponding figures are 81.49 years and 0.3908.

ERRORS IN MEASURES OF STAR IMAGES AND SPECTRA.—Some results of great importance to those concerned in the photographic determinations of stellar positions, and of the wave-lengths of stellar spectra, are published by Prof. Perrine in Bulletin No. 143 of the Lick Observatory.

The experience of everyone engaged in such work is that the discordances found in the measures are greater than can be accounted for by errors of measurement alone, and, whilst developing the method of determining stellar parallaxes by photography, Prof. Perrine has investigated the source of the outstanding discordances. His results indicate that the irregularity, in size and distribution, of the grains in the photographic film is the chief source of the trouble. Instead of each star image being a regular collection of equally sized grains, it is a complicated and irregular gathering of particles intersected by lanes and vacant spaces, and composed of bodies of different sizes. This irregularity leads to errors of setting, because the centre of such an agglomeration is so indefinite, and may depend more upon the structure of the particular part of the film acted upon than upon true position of the area illuminated.

PHYSICAL OBSERVATIONS OF THE NATIONAL ANTARCTIC EXPEDITION.¹

THE series of volumes now being issued by the Royal Society detailing the scientific observations made in the course of the *Discovery* expedition should impress upon the public the extent and variety of the problems that are under consideration, as well as inform them of the degree of success that has attended the efforts of those who have had to make the observations in trying circumstances. Many, unfortunately, fail to grasp the real object of such

¹ "Physical Observations, with Discussions by Various Authors." Prepared under the superintendence of the Royal Society. Pp. v+192. (London: Published by the Royal Society, 1908.)